Making Informed Decisions Using Data
Where Are We?

- Decide on a problem to solve.
- Determine how to measure process/improvement.
- Understand the current state.
- Obtain baseline measures
  - Formulate a data collection plan
  - Validate the data
- Analyze the current state and the measures to
  - Validate assumptions about the process
  - Prioritize and focus your improvements
  - Estimate the likely results of your changes
Essentials of Data Collection in QI

**Quality Improvement**
- Formulate your goal
- Define your scope
- Identify measures
  - Elements
  - Operational Definitions
  - Units of Measure
- Use available data
- Leverage appropriate statistical tools for analysis
- P-Value is interesting

**Research**
- Formulate your question
- Define your population
- Define your methods
- Carefully control your data sources
- Leverage appropriate statistical tools for analysis
- P value is king
Look to the Outcome

Output/Outcome is a product of the components or processes that produce it.

\[ Y = f(x) \]

http://media.tumblr.com/f592067382572a403457dbe86a150fee/tumblr_inline_mjvfr0n4SQ1qz4rgp.png
The Basic Quality Equation

\[ Y = f(x) \]

Commuter time = (time of day) + (driving speed) + (# of traffic lights) + (route chosen)
Essentials of Data Collection Plans in QI

1. Determine the questions you want to answer about your process
2. Think one level deeper than the surface question—segmentation factors
3. List out your data elements
4. Define each with an operational definition—equation, units of measure, location of data element in Epic
5. Identify what this data element is needed for — Y measure or one of the X’s
6. What is the defect definition for this element
Now is the time to exercise restraint!
## Data Collection Plan

<table>
<thead>
<tr>
<th>Data Element Name</th>
<th>Y/X</th>
<th>Type</th>
<th>Operational Definition</th>
<th>Source</th>
<th>Unit of measure</th>
<th>Defect Defn</th>
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### Key Questions: (ex: how much, how many, by whom)
- A
- B
- C
- D.

### Segmentation factors: (ex: provider name, clinic name, day of week etc…)
- A
- B
- C
- D.
Let’s formulate a data collection plan for your project.

- In table teams, use the data collection worksheet to list what data elements you would ask for.
  - What are the questions you are trying to answer?
    - How often does something happen?
    - How long does each part of the process take to complete?
    - What takes the most time?
  - If you had answers to these what other information might you suddenly want?
    - What are some key segmentation factors you would want to get to help answer these additional questions?

*Data Collection Tip*

Keep your data request as simple as possible to avoid delays.
Using Data Once You Get It
Two Views

- Look at data with respect to time
- Look at the shape, center and spread of the data
Say...what’s a mountain goat doing way up here in a cloud bank?
Sources of Variation

Variation is inherent in everything. The key is whether or not it is predictable variation or unpredictable variation.

**Two sources of variation:**

1. Common Cause - variation inherent in the process
2. Special Cause - variation from outside the normal process

**Two Possible Mistakes:**

Mistake 1: To react to an outcome as if it came from a special cause, when actually it came from common causes of variation.

Mistake 2: To react to an outcome as if it came from common causes of variation, when actually it came from a special cause.

**SPC charts facilitate correct identification of variation sources.**
Looking at Data With Respect to Time

The Statistical Process Control (SPC) Chart

- Upper Control Limit* (UCL)
- Average
- Lower Control Limit* (LCL)
Control Chart Basics

- 3σ-level Control Limits
  - Created by Dr. Walter Shewhart to minimize two types of mistakes
  - Placed empirically because they minimize the two types of mistakes
  - Are not probability limits

- Two types of Mistakes:
  - Calling a special cause of variation a common cause of variation (Missing a chance to identify a change in the process)
  - Calling a common cause of variation a special cause of variation (Interfering with a stable process or tampering, wasting resources looking for special causes of variation that do not exist)

- 8 Tests of Variation
  - Empirically derived by Shewhart
  - Common patterns to look for that indicate special cause variation

We want best efforts guided by theory. Confusing common causes with special causes will only make things worse. *W. Edwards Deming*
Run Charts

- Run charts show variation with respect to time. Run charts should look random. Non-random behavior is an indication of special cause variation. Variation that is due to something other than chance or common cause variation.
Trend Analysis Plot for Total Falls
Linear Trend Model
$Y_t = 30.41 + 0.1435 \times t$

Are we getting worse?
Actually we appear to have a stable system that produces a predictable number of falls month after month since 2013.
Did We Improve?

Xbar-S Chart of LOS Pre and Post Improvements

Sample Mean

UCL=153.4

LCL=91.2

Arrival Date

pre post
Looking at Shape, Center, Spread of Data
Key Learnings

• Determine what questions you want to answer before requesting data
  • Only ask for what you need - one puppy!
  • Think through what other questions you might have once you know the answers to your main questions
• Validate your data
• Understand the factors that contribute to variation in the data
• Use judgment to interpret the data - you haven’t controlled for major variables in a sample of convenience
• Let the data guide and inform your focused improvements